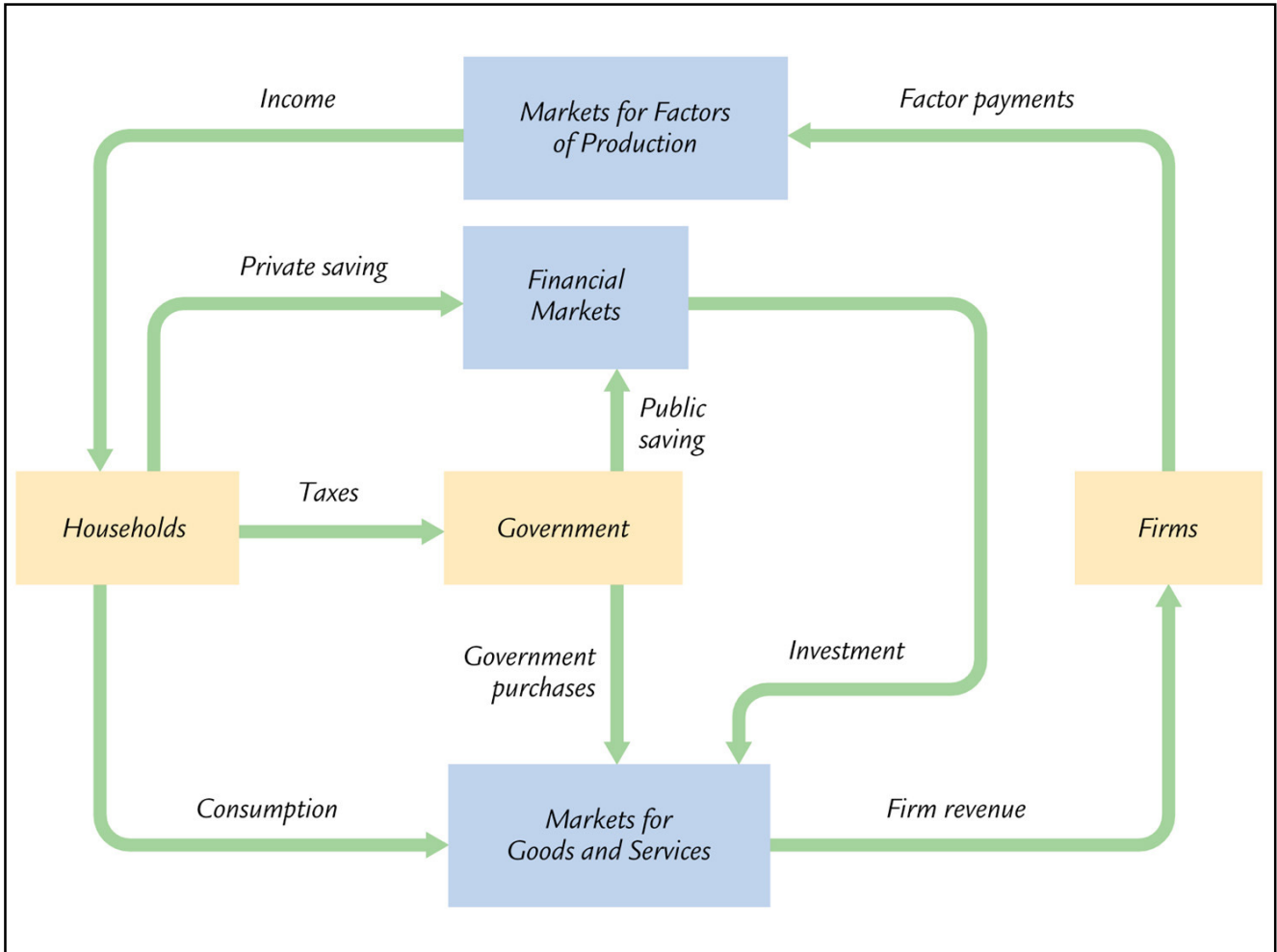


## **Chapter 3**

# **National Income: Where It Comes From And Where It Goes**

0



## The Neo-Classical Model

- Goal: to explain the more realistic circular flow
- **Supply Side** (firms): how total output(=income; GDP) is determined
- Supply Side: how total income is distributed
- **Demand Side**: how income is allocated among different uses (C, I, G)
- **Equilibrium**: how supply and demand equal

## GOODS & SERVICES MARKET SUPPLY SIDE

### 1. The Factors of Production (quantity of inputs)

***K*** = capital, tools, machines, and structures used in production

***L*** = labor, the physical and mental efforts of workers

# GOODS & SERVICES MARKET SUPPLY SIDE

## 2. The production function

- denoted  $Y = F(K, L)$
- shows how much output ( $Y$ ) the economy can produce from  $K$  units of capital and  $L$  units of labor.
- reflects the economy's level of technology.
- exhibits ***constant returns to scale***.

Returns to scale (review)

Initially  $Y_1 = F(K_1, L_1)$

Scale all inputs by the same factor  $z$ :

$$K_2 = zK_1 \quad \text{and} \quad L_2 = zL_1$$

(If  $z = 1.25$ , then all inputs are increased by 25%)

What happens to output,  $Y_2 = F(K_2, L_2)$  ?

- If constant returns to scale,  $Y_2 = zY_1$
- If increasing returns to scale,  $Y_2 > zY_1$
- If decreasing returns to scale,  $Y_2 < zY_1$

# GOODS & SERVICES MARKET SUPPLY SIDE

## **3. Assumptions of the model**

- Technology is fixed.
- The economy's supplies of capital and labor are fixed at

**GOODS & SERVICES**  
**MARKET**  
**SUPPLY SIDE**

Output is determined by the **fixed** factor supplies and the **fixed** state of technology:

$$\bar{Y} = F(\bar{K}, \bar{L})$$

## Question: How Total Income is Distributed

We will look for the answer using the factors of production market

### **Notation**

**$W$**  = nominal wage

**$R$**  = nominal rental rate

**$P$**  = price of output

**$W/P$**  = real wage (measured in units of output)

**$R/P$**  = real rental rate

## Question: How Total Income is Distributed

### Assumptions

- Technology is fixed.
- The economy's supplies of capital and labor are fixed at  $K = \bar{K}$  and  $L = \bar{L}$
- Competitive output and factor markets
- Rational firms

$$\begin{aligned} \rightarrow \max \pi &= (P \cdot Y) - (W \cdot L) - (R \cdot K) \\ &= (P \cdot F(K, L)) - (W \cdot L) - (R \cdot K) \end{aligned}$$

## Question: How Total Income is Distributed

- **Aggregate Supply of Labor**  
Fixed
- **Individual Supply of Labor**  
“Infinite” (due to competitive markets)
- **Demand for Labor**  
Basic idea:  
A firm hires each unit of labor  
if the cost does not exceed the benefit.  
**cost = real wage**  
**benefit = marginal product of labor**

**Question:** How Total Income is  
**Distributed**

- **MPL:**

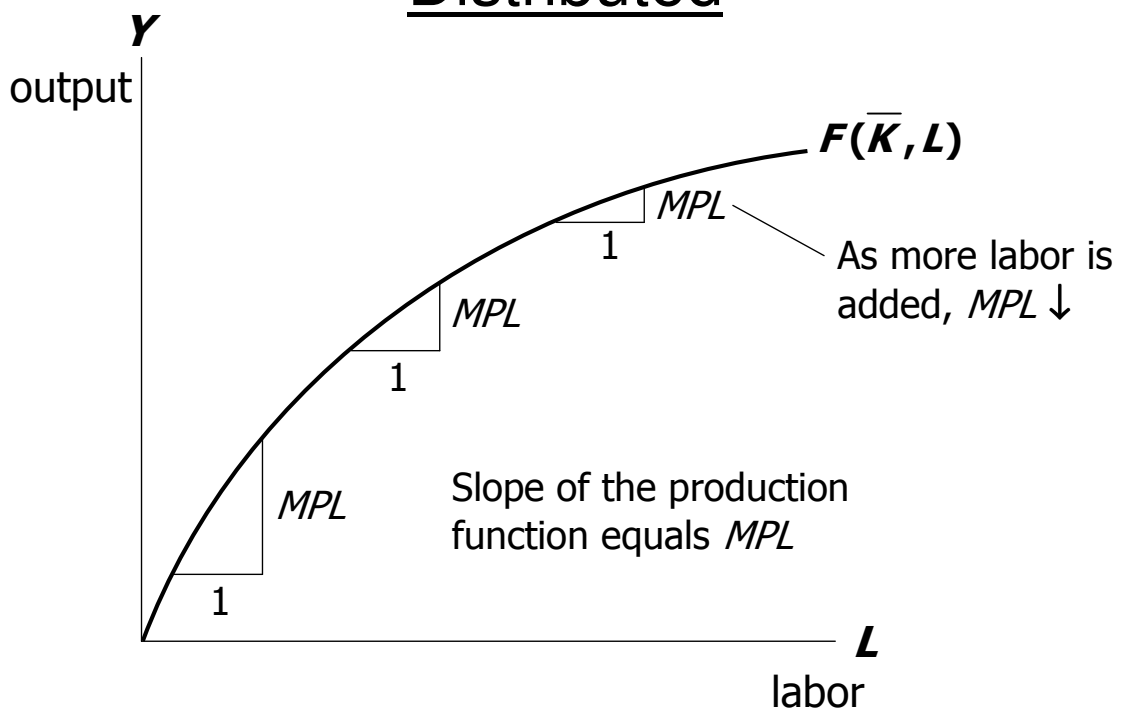
The extra output the firm can produce using an additional unit of labor (holding other inputs fixed):

$$MPL = F(K, L + 1) - F(K, L)$$

- **Diminishing MPL**

As a factor input is increased, its marginal product falls (other things equal).

**Question:** How Total Income is Distributed



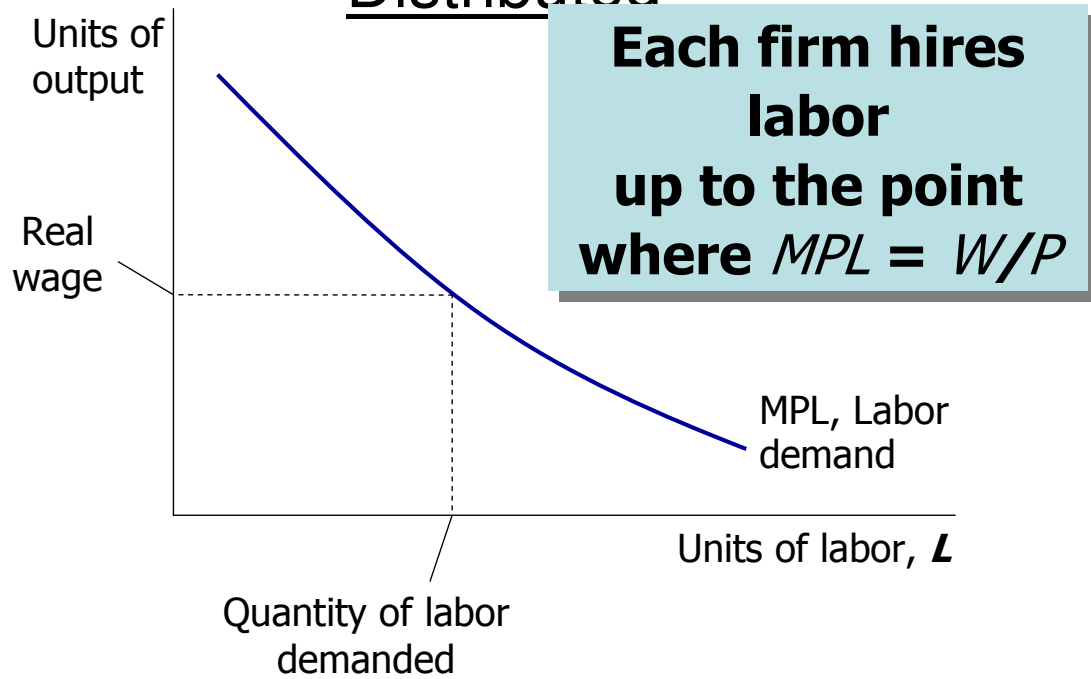
**Question: How Total Income is Distributed**

- The change in profit from hiring an additional unit of labor:

$$\Delta\pi=(P*MPL)-W$$

→  $MPL=(W/P)$  is the rule!!!

**Question:** How Total Income is Distributed



## Question: How Total Income is Distributed

- **Aggregate Supply of Capital**  
Fixed
- **Demand for Capital**

Similarly  $MPK = R/P$  is the rule for finding optimal capital quantity.

diminishing returns to capital:  $MPK \downarrow$  as  $K \uparrow$

The  $MPK$  curve is the firm's demand curve for renting capital.

Firms maximize profits by choosing  $K$  such that  $MPK = R/P$ .

## Question: How Total Income is Distributed

Neo-Classical Theory

- *states that each factor input is paid its marginal product*
- *accepted by most economists*

**Question:** How Total Income is Distributed

$$\text{total labor income} = \frac{W}{P} \bar{L} = \mathbf{MPL} \times \bar{L}$$

$$\text{total capital income} = \frac{R}{P} \bar{K} = \mathbf{MPK} \times \bar{K}$$

$$Y = (\mathbf{MPL} * L) + (\mathbf{MPK} * K) + \text{Economic Profit}$$

## Question: How Total Income is Distributed

- If production function has constant returns to scale, markets are competitive and firms are maximizing profits → Economic profits=0

$$\begin{array}{c} \bar{Y} \\ \diagdown \\ \text{national} \\ \text{income} \end{array} = \underbrace{MPL \times \bar{L}}_{\text{labor income}} + \underbrace{MPK \times \bar{K}}_{\text{capital income}}$$

# GOODS & SERVICES MARKET DEMAND SIDE

Components of aggregate demand:

**C** = consumer demand for g & s

**I** = demand for investment goods

**G** = government demand for g & s

(closed economy: no **NX**)

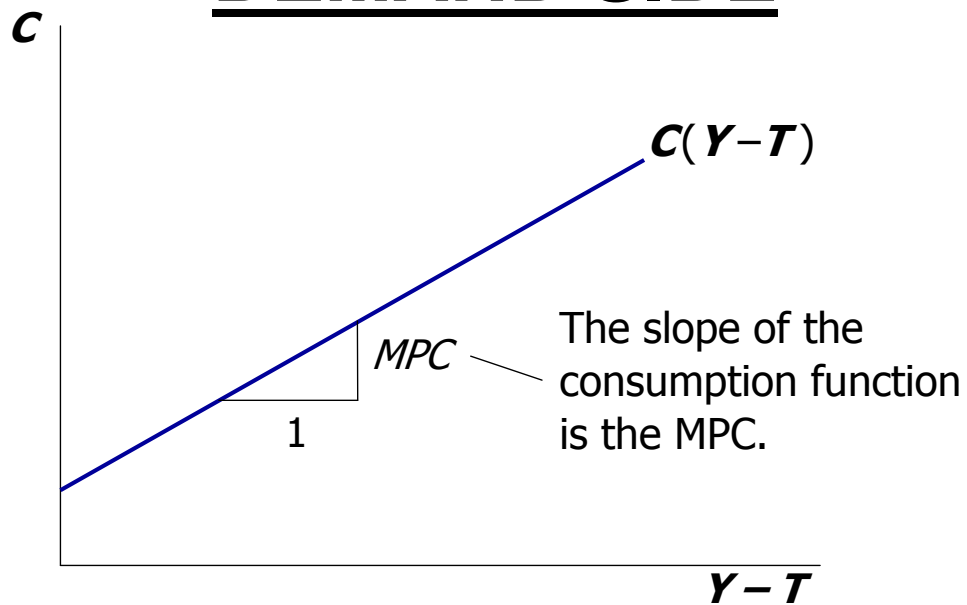
# GOODS & SERVICES MARKET

## DEMAND SIDE

### 2.1 Consumption

- HH receive income  $\rightarrow$  pay taxes  $\rightarrow$  consume and save from the disposable income
- **Disposable income** is total income minus total taxes:  $Y - T$
- Consumption function:  $C = C(Y - T)$   
Shows that  $\uparrow(Y - T) \Rightarrow \uparrow C$
- The **marginal propensity to consume** is the increase in  $C$  caused by a one-unit increase in disposable income.

# GOODS & SERVICES MARKET DEMAND SIDE



# GOODS & SERVICES MARKET

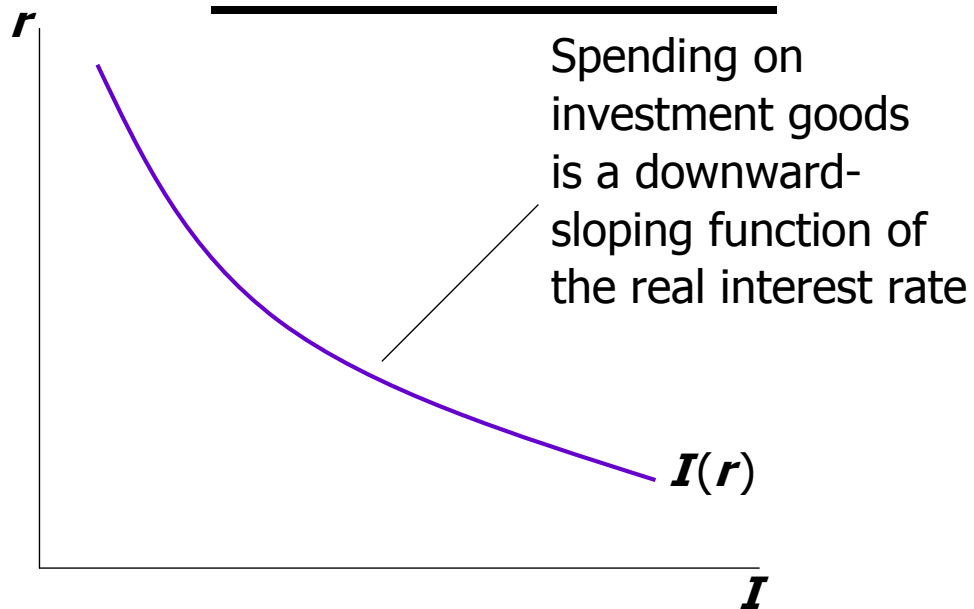
## DEMAND SIDE

### 2.2 Investment

- The investment function is  $I = I(r)$ , where  $r$  denotes the **real interest rate**, the nominal interest rate corrected for inflation.
- The real interest rate is
  - the cost of borrowing
  - the opportunity cost of using one's own funds to finance investment spending.

So,  $\uparrow r \Rightarrow \downarrow I$

# GOODS & SERVICES MARKET DEMAND SIDE



# GOODS & SERVICES MARKET

## DEMAND SIDE

### 2.3. Government Spending

- $G$  includes government spending on goods and services.
- $G$  excludes *transfer payments*
- Assume government spending and total taxes are exogenous:

$$\bar{G} = G \quad \text{and} \quad \bar{T} = T$$

## GOODS & SERVICES MARKET DEMAND SIDE

- $T$ =taxes-transfers
- When  $T > G$ ,  
**budget surplus** =  $(T - G)$  = public saving
- When  $T < G$ ,  
**budget deficit** =  $(G - T)$  and public saving is negative.
- When  $T = G$ ,  
budget is balanced and public saving = 0.

# GOODS & SERVICES MARKET EQUILIBRIUM

- Agg. demand:  $C(\bar{Y} - \bar{T}) + I(r) + \bar{G}$
- Agg. supply:  $\bar{Y} = F(\bar{K}, \bar{L})$
- Equilibrium:  $\bar{Y} = C(\bar{Y} - \bar{T}) + I(r) + \bar{G}$

*The real interest rate adjusts  
to equate demand with supply.*

# FINANCIAL MARKET

The Loanable Funds Approach

- A simple supply-demand model of the financial system.

- One asset: “loanable funds”

demand for funds:investment

supply of funds:saving

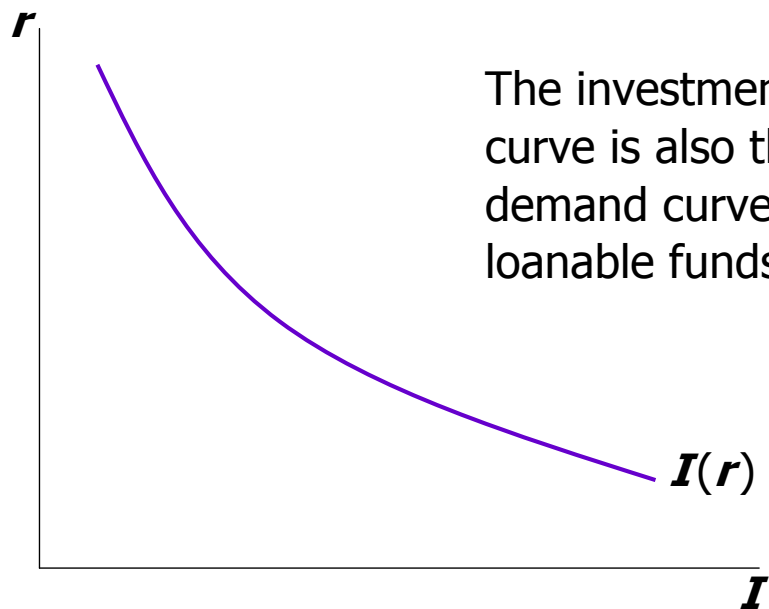
“price” of funds: real interest rate

# FINANCIAL MARKET

## 1. The demand for loanable funds:

- comes from investment:  
Firms borrow to finance spending on plant & equipment, new office buildings, etc.  
Consumers borrow to buy new houses.
- depends negatively on  $r$ , the “price” of loanable funds (the cost of borrowing).

# FINANCIAL MARKET



The investment curve is also the demand curve for loanable funds.

# **FINANCIAL MARKET**

**2. The supply of loanable funds** comes from saving:

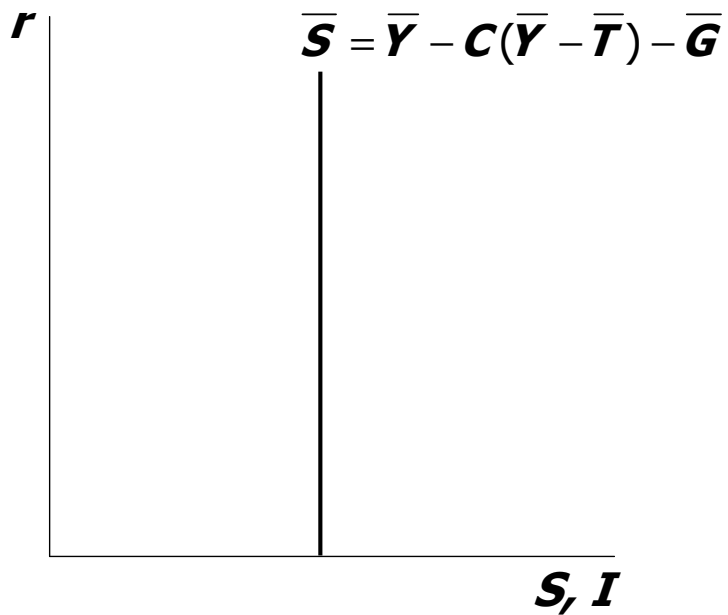
- Households use their saving to make bank deposits, purchase bonds and other assets. These funds become available to firms to borrow to finance investment spending.
- The government may also contribute to saving if it does not spend all of the tax revenue it receives.

# FINANCIAL MARKET

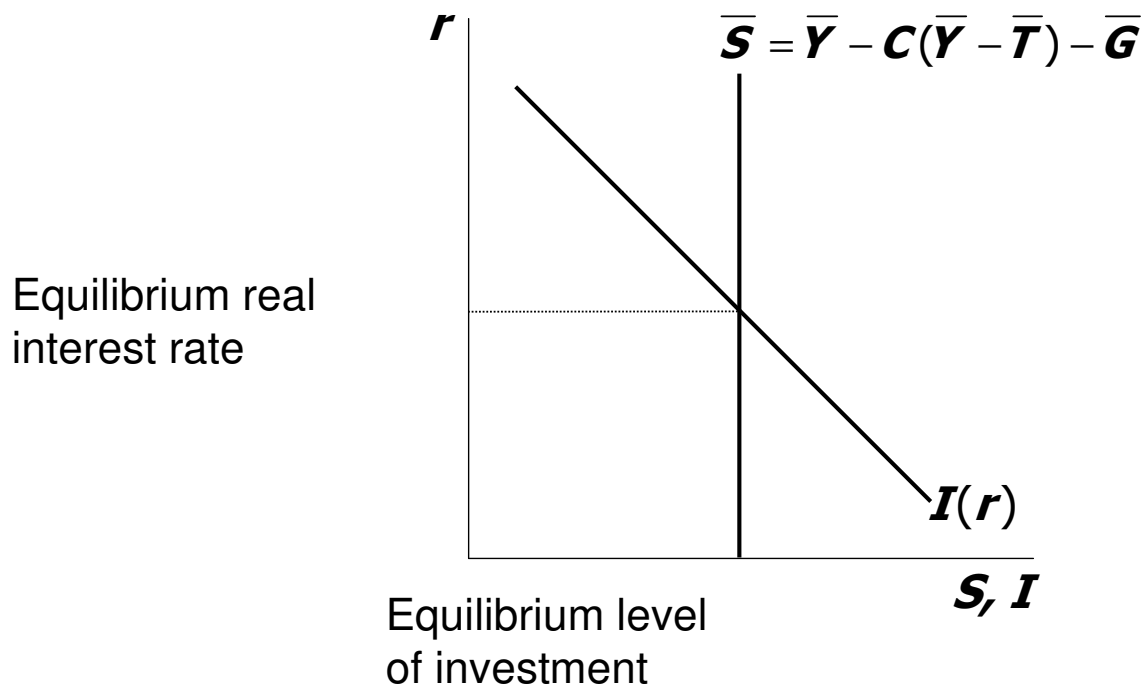
- private saving =  $(Y - T) - C$
- public saving =  $T - G$
- national saving,  $S$ 
  - = private saving + public saving
  - =  $(Y - T) - C + T - G$
  - =  $Y - C - G$

# FINANCIAL MARKET

National saving does not depend on  $r$ , so the supply curve is vertical.



# FINANCIAL MARKET



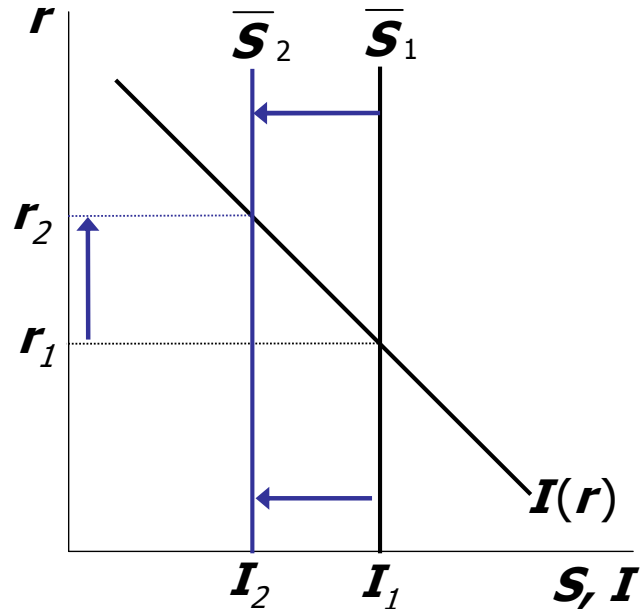


## **Equilibrium: Changes**

1. Changes in “saving”
  - Changes in government spending
  - Changes in taxes
2. Changes in “investment”
  - Technological change
  - Tax changes in favor of investors

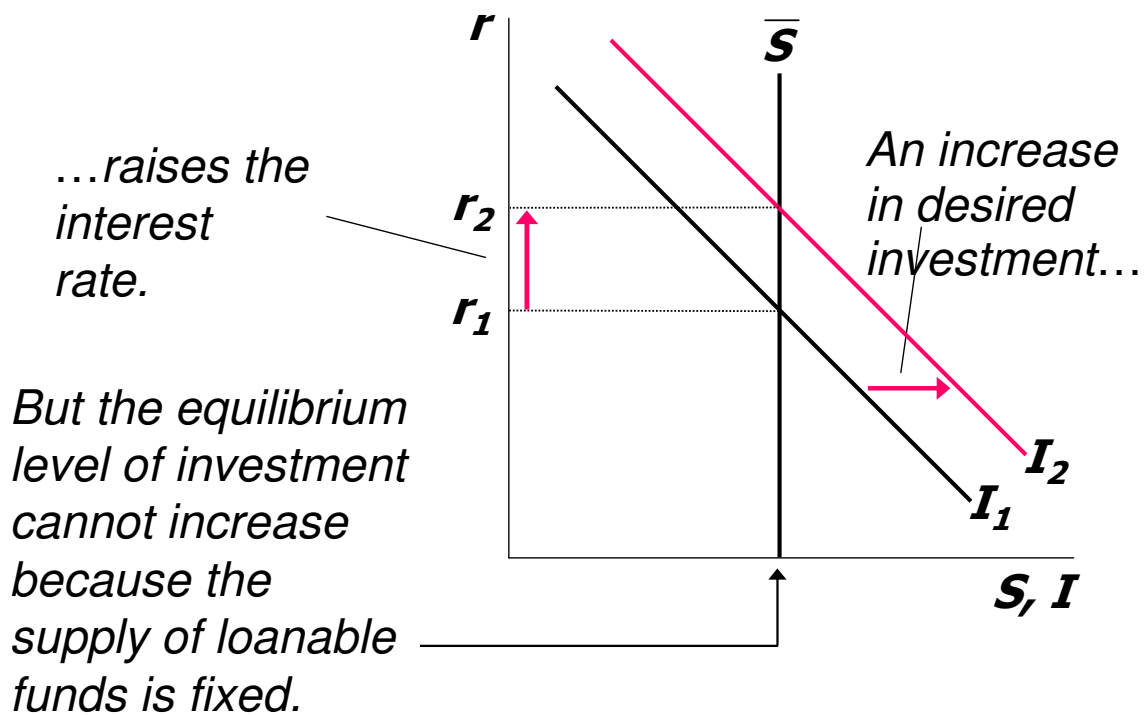
## An increase in G or a decrease in T

1. The increase in the deficit reduces saving...
2. ...which causes the real interest rate to rise...
3. ...which reduces the level of investment.



36

# An increase in investment demand

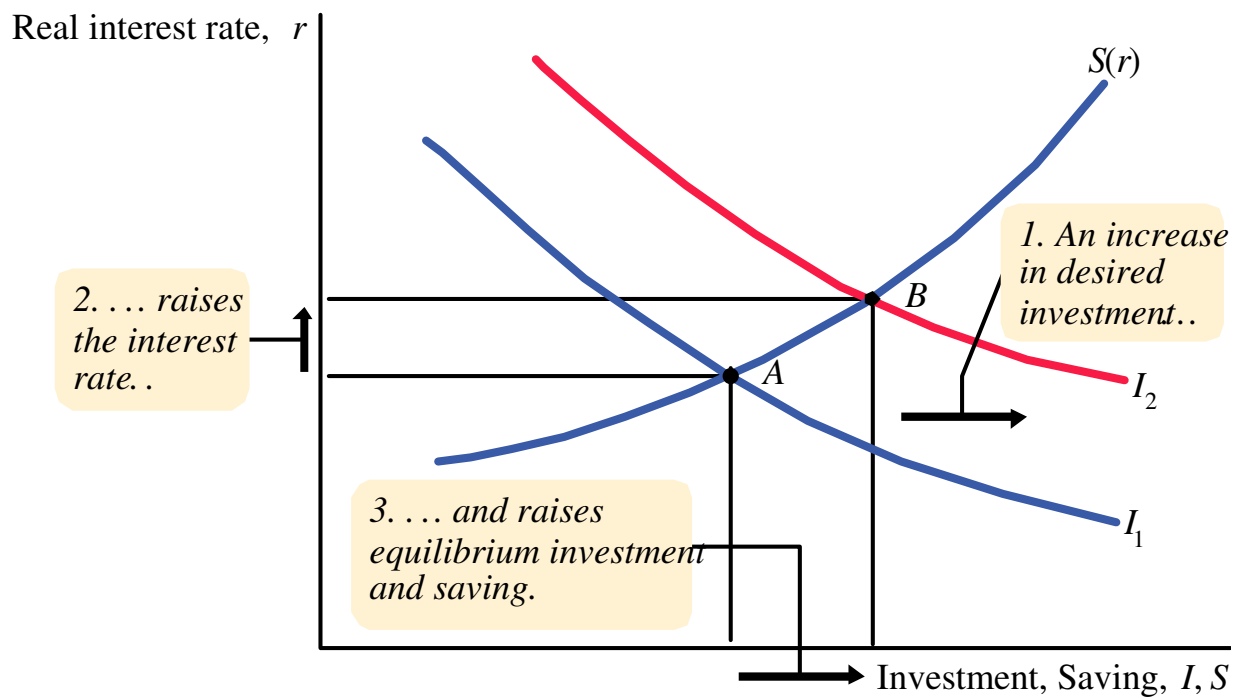


37

## What if $S=S(r)$ ?

- Why might saving depend on  $r$ ?
- How would the results of an increase in investment demand be different?
  - Would  $r$  rise as much?
  - Would the equilibrium value of  $I$  change?

## An increase in investment demand when $S(r)$



39

## **Chapter Summary**

1. Total output is determined by
  - how much capital and labor the economy has
  - the level of technology
2. Competitive firms hire each factor until its marginal product equals its price.
3. If the production function has constant returns to scale, then labor income plus capital income equals total income (output).

## **Chapter Summary**

4. The economy's output is used for
  - consumption  
(which depends on disposable income)
  - investment  
(depends on the real interest rate)
  - government spending  
(exogenous)
5. The real interest rate adjusts to equate the demand for and supply of
  - goods and services
  - loanable funds

## **Chapter Summary**

6. A decrease in national saving causes the interest rate to rise and investment to fall. An increase in investment demand causes the interest rate to rise, but does not affect the equilibrium level of investment if the supply of loanable funds is fixed.